MAY 2 5 1982

910-D-

SI 1.27:348

ORIGINAL

# A Revision of the Genus *Chloronia* (Neuroptera: Corydalidae)

COMPLETED

34

NORMAN D. PENNY

and

OLIVER S. FLINT, JR.

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 348

## SERIES PUBLICATIONS OF THE SMITHSONIAN INSTITUTION

Emphasis upon publication as a means of "diffusing knowledge" was expressed by the first Secretary of the Smithsonian. In his formal plan for the Institution, Joseph Henry outlined a program that included the following statement: "It is proposed to publish a series of reports, giving an account of the new discoveries in science, and of the changes made from year to year in all branches of knowledge." This theme of basic research has been adhered to through the years by thousands of titles issued in series publications under the Smithsonian imprint, commencing with *Smithsonian Contributions to Knowledge* in 1848 and continuing with the following active series:

*Smithsonian Contributions to Anthropology*
*Smithsonian Contributions to Astrophysics*
*Smithsonian Contributions to Botany*
*Smithsonian Contributions to the Earth Sciences*
*Smithsonian Contributions to the Marine Sciences*
*Smithsonian Contributions to Paleobiology*
*Smithsonian Contributions to Zoology*
*Smithsonian Studies in Air and Space*
*Smithsonian Studies in History and Technology*

In these series, the Institution publishes small papers and full-scale monographs that report the research and collections of its various museums and bureaux or of professional colleagues in the world of science and scholarship. The publications are distributed by mailing lists to libraries, universities, and similar institutions throughout the world.

Papers or monographs submitted for series publication are received by the Smithsonian Institution Press, subject to its own review for format and style, only through departments of the various Smithsonian museums or bureaux, where the manuscripts are given substantive review. Press requirements for manuscript and art preparation are outlined on the inside back cover.

S. Dillon Ripley
*Secretary*
Smithsonian Institution

BEST DOCUMENT AVAILABLE

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 348

# A Revision of the Genus *Chloronia* (Neuroptera: Corydalidae)

*Norman D. Penny*
*and Oliver S. Flint, Jr.*

SMITHSONIAN INSTITUTION PRESS
City of Washington
1982

I

## ABSTRACT

Penny, Norman D., and Oliver S. Flint, Jr. A Revision of the Genus *Chloronia* (Neuroptera: Corydalidae). *Smithsonian Contributions to Zoology*, number 348, 27 pages, 53 figures, 1982.—A key, descriptions, distributions, and illustrations are given for the 10 known species of the Neotropical genus *Chloronia*. The larvae of *C. hieroglyphica*, the first known for the genus, are described. *Chloronia winthemi* (Davis), *C. meridionalis* Weele, and *C. ocellaris* Navás are newly synonymized with *C. corripiens* (Walker), and *C. hieratica* Navás is synonymized with *C. mirifica* Navás. Three new species, *C. plaumanni* from Brazil, *C. banksiana* from Venezuela, and *C. gloriosoi* from Panama, are described.



## RESUMO

Chave, descrições, distribuições geográficas e illustrações são apresentadas para as dez espécies do gênero neotropical *Chloronia*. Descricão de larva para esse género e feita pela primeira vez, usando a larva de *C. hieroglyphica*. *Chloronia winthemi* (Davis), *C. meridionalis* Weele, e *C. ocellaris* Navás são sinonomias de *C. corripiens* (Walker), e *C. hieratica* Navás e sinonimia de *C. mirifica* Navás. Três novas espécies, *C. plaumanni* do Brasil, *C. banksiana* de Venezuela, e *C. gloriosoi* de Panama, são descritas.



OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Smithsonian Year*. SERIES COVER DESIGN: The coral *Montastrea cavernosa* (Linnaeus).

---

Library of Congress Cataloging in Publication Data
Penny, Norman D.
A revision of the genus Chloronia (Neuroptera-Corydalidae)
(Smithsonian contributions to zoology ; no. 348)
Bibliography: p.
Supt. of Docs. no.: SI 1.27:348
1. Chloronia—Classification. 2. Insects—Classification. 3. Insects—Latin America—Classification. I. Flint, Oliver S. II. Title. III. Series.
QL1.S54 no. 348 [QL513.C7] 591s 81-607069 [595.7'42] AACR2



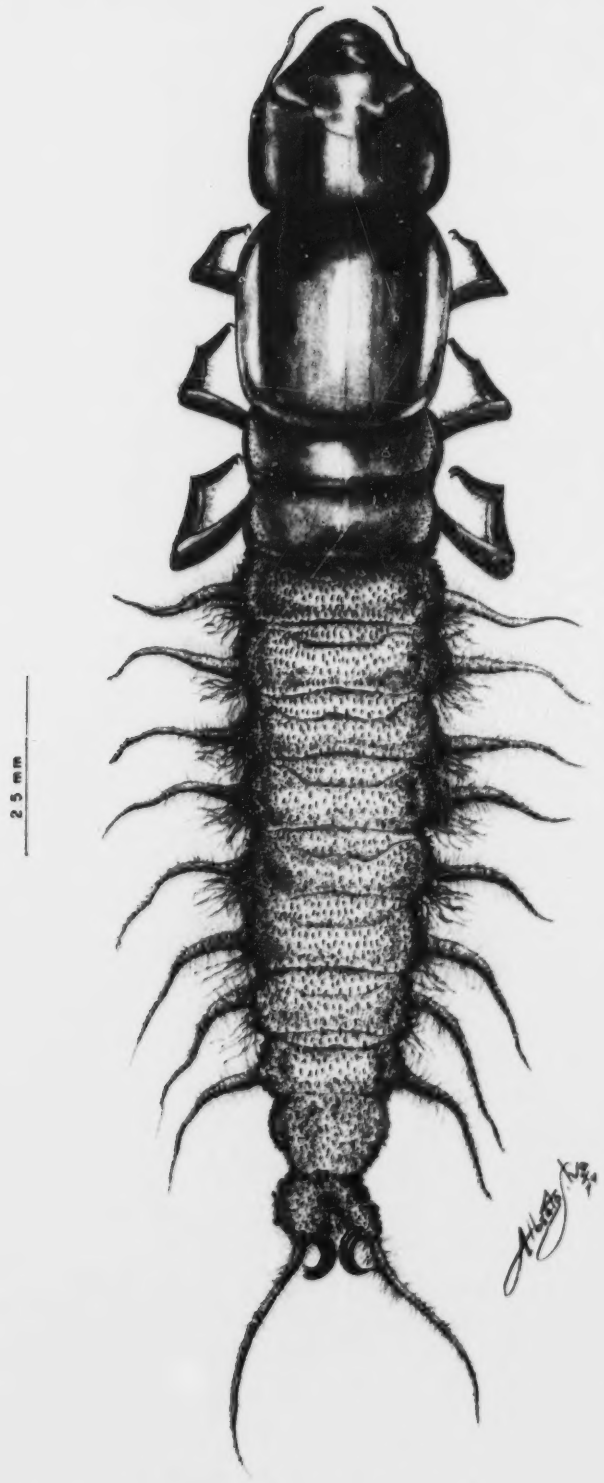
BEST DOCUMENT AVAILABLE II

# Contents


| | Page |
|---|---|
| Introduction | 1 |
| Ecology | 1 |
| Phylogeny | 1 |
| Acknowledgments | 3 |
| Genus *Chloronia* Banks | 3 |
| Adult | 3 |
| Larva | 4 |
| Discussion | 4 |
| Key to Species of *Chloronia* | 4 |
| *Chloronia corripiens* (Walker) | 5 |
| *Chloronia plaumanni*, new species | 6 |
| *Chloronia antilliensis* Flint | 7 |
| *Chloronia banksiana*, new species | 8 |
| *Chloronia bogotana* Weele | 8 |
| *Chloronia hieroglyphica* (Rambur) | 9 |
| *Chloronia mirifica* Navás | 10 |
| *Chloronia gloriosoi*, new species | 11 |
| *Chloronia pallida* (Davis) | 12 |
| *Chloronia mexicana* Stitz | 13 |
| Literature Cited | 15 |
| Figures 2–53 | 16 |




BEST DOCUMENT AVAILABLE




FRONTISPIECE.—Presumptive larva of *Chloronia hieroglyphica* (Rambur).

BEST DOCUMENT AVAILABLE

IV

# A Revision of the Genus *Chloronia* (Neuroptera: Corydalidae)

*Norman D. Penny*
*and Oliver S. Flint, Jr.*

## Introduction

The Neotropical megalopteran genus *Chloronia* has not been revised since its original description by Nathan Banks in 1908. Weele (1910) listed five species in the genus, and subsequent descriptions by Stitz (1914), Navás (1925, 1928a, 1934), and Flint (1970) and transfer of *C. pallida* from *Corydalus* by Penny (1977) brought the number of species in the genus to 11. Until now, the immature stages have been unknown.

Many of the first described species of *Chloronia* were placed in the Asian genus *Neuromus*, with which it shares the characteristic dentate ventral appendages of the male. Banks (1908) separated *Chloronia* from *Neuromus* as a new subgenus on the basis of three crossveins between R and Rs in the former group, as opposed to four crossveins in *Neuromus*, and branches of M forked only near the wing margin in *Chloronia*. Weele (1910) elevated *Chloronia* to generic rank, but the characters used in his key make separation from the New World genus *Corydalus* impossible without using characters of the male genitalia. The characteristic of three crossveins between R and Rs is shared with *Corydalus*, but the third cell formed by these crossveins is more elongate than the second cell in *Chloronia* and shorter or equal in length in *Corydalus*. There are generally more branches of CuA in *Corydalus*, but this character is variable. Alive, *Chloronia* presents a bright lemon-yellow coloration, in contrast to *Corydalus*, which normally is light to dark brown or gray in wing and body coloration; however, among preserved museum specimens *Chloronia* turns light stramineous, and many *Corydalus* specimens fade to an approximation of this same coloration. The most distinctive difference between *Corydalus* and *Chloronia* remains the terminal tooth of the male ninth gonostyles of *Chloronia*.

ECOLOGY.—Adult *Chloronia* are phototropic, and most museum specimens are collected at lights in the night. Adults are always found near running water, but stream size varies from the Rio Salto at El Salto, San Luis Potosi State, Mexico, with a width of about 20 m, to Igarapé Barro-Branco, Reserva Ducke near Manaus, Amazonas State, Brazil, with a width of about one meter. This difference in stream size may reflect specific requirements, because *Chloronia hieroglyphica* never is found near large streams and rivers in northern Brazil. Larvae are predatory and may feed on quantities of *Simulium* larvae (Gorayeb and Pinger, 1978).

PHYLOGENY.—The genus *Chloronia* is evidently related to *Corydalus* and *Platyneuromus*. Old faded specimens of *Chloronia* are often separable with

*Norman D. Penny, Instituto Nacional de Pesquisas da Amazonia, Manaus, Amazonas, Brazil. Oliver S. Flint, Jr., Department of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.*



BEST DOCUMENT AVAILABLE

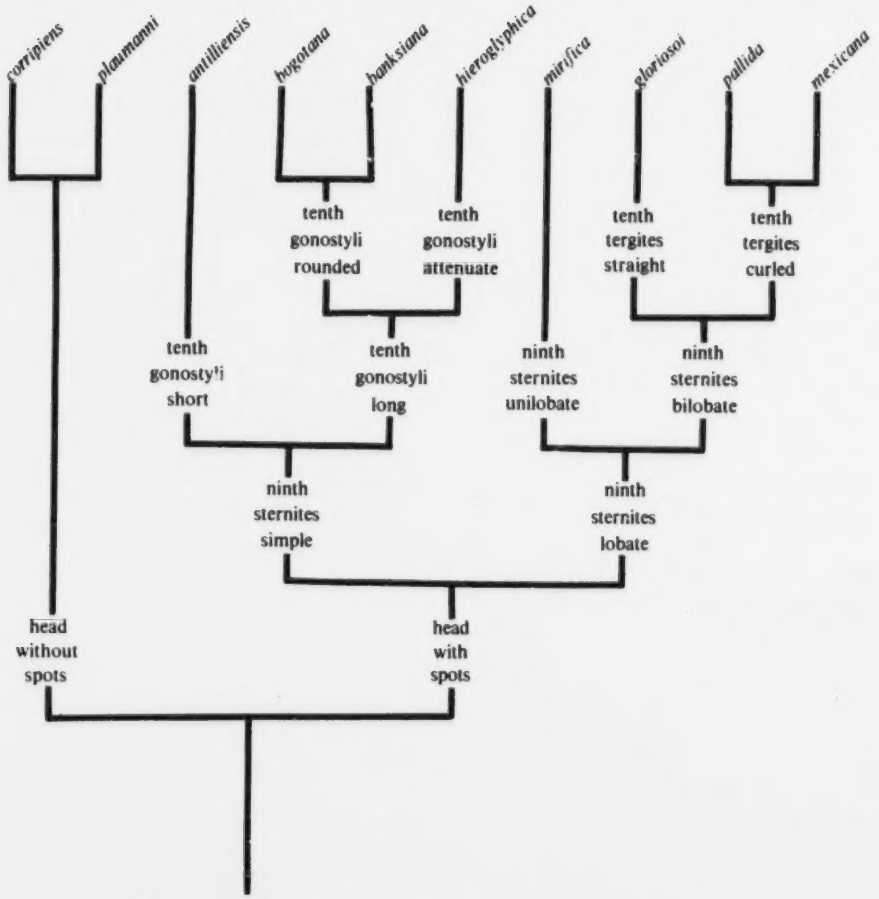



FIGURE 1.—Hypothetical phylogeny for the species of *Chloronia*.

certainty from *Corydalus* and *Platyneuromus* only after examination of the male genitalia. The Asiatic genus *Neuromus* is often mentioned as a close relative because of a general similarity in appearance, but close examination of the male genitalia and venation show it to be more closely related to the other Asian genera; however, the exact relationship among the three New World genera awaits further analysis (Glorioso, 1981).

The Brazilian pair of species, *C. corripiens* and *C. plaumanni*, appear to be very closely related and probably the most primitive in the genus. They lack the usual dark marks on the rear of the head and have small 10th gonocoxites and quadrate ninth sternites, as do the related genera.

The Lesser Antillean *C. antilliensis* probably is related to the primitive pair, specializing in the development of the pair of dark spots on the posterior of the head and the paired clusters of spinous setae on the ninth tergum.

The three exclusively South American species (at the present state of our knowledge) appear to form another group of species, specialized by the elongation of the 10th gonostyli but still retaining the roughly quadrate ninth sternites. *Chloronia bogotana* and *C. banksiana* are apparently sister species separable primarily by coloration; however, due to the loss of the male genitalia of the unique example of *C. bogotana*, such an assumption is a bit risky. *Chloronia hieroglyphica* appears to

BEST DOCUMENT AVAILABLE

be the most highly evolved of this group, the ninth and 10th gonostyli being quite specialized.

The final group of species may have developed in northwestern South America or Central America. This group of four species has the ninth sternites rather strongly modified. *Chloronia mirifica* still has a simple elongate 10th tergite and no specialized setae on the ninth and 10th tergites, and the ninth sternite is less strongly modified. The three species, *C. gloriosoi*, *C. mexicana*, and *C. pallida*, all have developed three paired clusters of specialized setae on the ninth and 10th tergites, and the posterior and lateral margins of the ninth sternites are produced into elongate, hairy lobes. *Chloronia gloriosoi* still retains the primitive elongate 10th tergite but has modified the shape of the ninth gonostyli. *Chloronia mexicana* and *C. pallida* are closely related (they may be no more than color varieties) and are the most highly evolved in the genus. The 10th tergites in this pair are strongly twisted.

ACKNOWLEDGMENTS.—We wish to thank the curators noted below for material examined from the following museums:

| | |
|---|---|
| BMNH | British Museum of Natural History, London, England, Dr. P. C. Barnard |
| CAS | California Academy of Sciences, San Francisco, California, U.S.A., Dr. D. H. Kavanaugh |
| CFP | Nova Teutônia, Santa Catarina, Brazil, Mr. Fritz Plaumann |
| CIG | Belém, Pará, Brazil, Mr. Inocêncio Gorayeb |
| MPEG | Museu Paraense Emilio Goeldi, Belém, Pará, Brazil, Dr. W. L. Overal |
| MCZ | Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U.S.A., Ms. M. K. Thayer |
| MNHN | Museum National de Histoire Naturelle, Paris, France, Dr. Jean Legrand and S. Kelner Pillault |
| MZ-USP | Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil, Dr. José Guimaraes |
| NMW | Naturhistorisches Museum Wien, Vienna, Austria, Dr. Alfred Kaltenbach |
| NRS | Naturhistoriska Riksmuseet, Stockholm, Sweden, Dr. Per Inge Persson |
| OHSU | Ohio State University, Columbus, Ohio, U.S.A., Mr. Michael Glorioso |
| RNH | Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands, Dr. P. H. van Doesburg, Jr. |
| SEM | Snow Entomological Museum, University of Kansas, Lawrence, Kansas, U.S.A., Dr. George Byers |
| TAI | Texas A & I University, Kingsville, Texas, U.S.A., Dr. James E. Gillaspy |
| UNAM | Instituto de Biologia, Universidad Nacional Autonoma de Mexico, Mexico City, Mexico, Dr. J. Bueno Soria |
| ZSBS | Zoologische Sammlung des Bayerischen Staates, Munich, Germany, Dr. Wolfgang Dierl |

We acknowledge with gratitude the help of staff artists in preparing the larval habitus drawings: Sr. Alberto Silva, Instituto Nacional de Pesquisas da Amazonia (Frontispiece), and Mrs. Elaine R. Snyder Hodges, Smithsonian Institution (Figures 2–4). Mr. Victor Krantz, Smithsonian Institution, made all the wing photographs. In addition, Dr. H. Wolda, Smithsonian Tropical Research Institute, Balboa, Panama, generously donated the types of *C. gloriosoi* to the National Museum of Natural History. His collections made at the Fortuna Dam site were made possible by the generous cooperation of the Panamanian Electricity Company (I.R.H.E.).

## Genus *Chloronia* Banks

*Chloronia* Banks, 1908:30.—Weele, 1909:252; 1910:30.—Penny, 1977:7.—Glorioso, 1981:253 [type-species: *Hermes corripiens* Walker, 1860, by Weele, 1909].

ADULT.—Head prognathous, quadrate, with lateral post-ocular tooth on either side. Mandible prominent but not longer than head; with 2 mesal teeth; size not dimorphic between sexes. Maxilla with prominent stipes and 5-segmented palpus. Maxillary palpi 3-segmented. Antennae filiform, with 37 to 53 flagellar segments. Three ocelli.

Pronotum quadrate, long as meso- and metanota combined. Legs elongate, with single, small tibial spur and 5 tarsal segments. Costal area of wings wide, 25–35 costal crossveins, some of them forked. Three R-Rs crossveins, rarely 4. 3rd R-Rs cell longer than 2nd R-Rs cell. $M_{1+2}$ forked; $M_{3+4}$ unforked. CuA with 2 to 5 branches. CuP not branched.

Abdomen of male with sclerotized 10th tergite and ventral 9th gonostyles, fused 10th gonocox-

BEST DOCUMENT AVAILABLE

ites, 10th gonostyles and membranous aedeagus. 9th gonostyles with terminal tooth.

LARVA.—Head reddish brown. Occiput quadrate, with posterolateral crescent-shaped ridges. Clypeus trapezoidal; labrum quadrate. Mandibles heavily sclerotized, prominent, with 3 mesal teeth. Maxillae ventral, elongate, cylindrical; each bearing an apical palpus and galea. Labium quadrate, with apical, 3-segmented palpi. Antennae 5-segmented; 1st segment small, recessed within basal fossa. Six ocelli grouped laterad behind each antenna.

Thorax reddish brown. Pronotum finely rugulose, without maculation, except for 4 lateral spots that appear late in development; covered by fine setae and evenly spaced, larger setae along lateral margins. Meso- and metanota mottled yellowish brown; covered by long setae; without inflated setae. Pleural and ventral areas of thorax membranous; covered by very short, inflated setae.

Legs reddish brown to yellowish brown with many large spines; consisting of conical coxa, cylindrical trochanter, femur, tibia, and single tarsal segment.

Abdomen with first 7 segments bearing lateral, tapered respiratory gills and finger-like, ventrolateral respiratory gills connected to tripartite bases. Segment 8 bears lateral gills but lacks ventrolateral gills. Segment 9 lacks both types of gills. Segment 10 bipartite; each half bearing caudal, tapered gill and 2 recurved heavily sclerotized, curved claws. Entire surface of abdomen covered by very short and intermixed long, inflated setae.

DISCUSSION.—Larval *Chloronia* have not been described before. Although no specimens were reared, a series of specimens from Igarapé Barro-Branco has been collected, where only adults of *Chloronia hieroglyphica* have been obtained after intensive collecting. One specimen (Frontispiece) appears to be mature and bears beneath the exoskeleton the pronotal markings of the adult. The above diagnosis is based on this material.

In addition to these larvae, there are several more collections available from Ecuador that clearly belong to two other species of the genus. The three larval types may be easily distinguished by the sculpture and proportions of the head and pronotum and by the vestiture of the thorax and abdomen. All these specimens differ from *Corydalus* larvae primarily by the lack of muscle scars and mottled pigmentation on the head and pronotum, which is clearly apparent even in small larvae of *Corydalus*.

### Key to Species of *Chloronia*

1. Head with a pair of fuscous spots posteriorly ..... 3
   Head unicolorous or with lateral margin infuscate ..... 2
2. Lateral margin of head fuscous ..... ***C. plaumanni***, new species
   Lateral margin unmarked ..... ***C. corripiens*** (Walker)
3. Apical two-thirds of antenna infuscate ..... ***C. mexicana*** Stitz
   Antenna predominately yellow, apical 5–6 segments may be darkened . 4
4. Ninth sternum of male with posterior, and often lateral, margin produced into distinct elongate lobes ..... 5
   Ninth sternum quadrate, or with posterior margin produced into no more than a broad obtuse mesal angle ..... 7
5. Tenth tergite at least twice as long as ninth gonostylus, when relaxed virtually straight ..... 6
   Tenth tergite less than twice as long as ninth gonostylus, apical half sharply curled ..... ***C. pallida*** (Davis)
6. Ninth gonostylus with an enlarged posterobasal angle; tenth gonostylus long and slender ..... ***C. gloriosoi***, new species

BEST DOCUMENT AVAILABLE

Ninth gonostylus slightly narrowed basally; tenth gonostylus very broad basally, tapering to sharp point ..... ***C. mirifica*** Navás

7. Tenth gonostylus short and rounded, as long as wide..***C. antilliensis*** Flint
   Tenth gonostylus 3 or 4 times as long as broad ..... 8
8. Ninth gonostylus with apex distinctly narrowed and produced into a sharp apical tooth; tenth gonostylus shouldered at midlength ..... ***C. hieroglyphica*** (Rambur)
   Ninth gonostylus inflated apicad, apex broadly rounded and bearing a distinct apical tooth; tenth gonostylus elongate, cylindrical ..... 9
9. Head smooth and shining anteriad to antennae; forewing with marks in cells broad and diffuse, wing base with darker marks only on crossveins ..... ***C. bogotana*** Weele
   Head rugose anteriad to antennae; forewings with marks in cells narrow and distinct, wing base with many spots on veins and in cells ..... ***C. banksiana***, new species

### *Chloronia corripiens* (Walker)

FIGURES 6, 11–13, 40–42

*Hermes corripiens* Walker, 1858:180.
*Neuromus corripiens.*—McLachlan, 1869:45.
*Chloronia corripiens.*—Banks, 1908:30.
*Corydalis affinis* [not Burmeister].—Hagen, 1861:321.
*Neuromus winthemi* Davis, 1903:470. [New synonymy.]
*Chloronia winthemi.*—Weele, 1910:34.
*Chloronia meridionalis* Weele, 1909:252. [New synonymy.]
*Chloronia ocellaris* Navás, 1934:19. [New synonymy.]

Male holotype of *C. corripiens* is from the Saunders collection in the British Museum. Holotype female of *C. winthemi* is in the Museum of Comparative Zoology at Harvard University, as is the Hagen specimen of *C. affinis*. The holotype male of *C. meridionalis* is in Leyden, Netherlands, and is now lacking the genitalia. The whereabouts of the holotype female of *C. ocellaris* is unknown, and it is presumed to be lost.

DESCRIPTION.—Present description is based on six males, 14 females, and the holotypes of *Hermes corripiens*, *Neuromus winthemi*, and *Chloronia meridionalis*.

*Head:* Variably rugose anteriad to antennae, pale yellow with fuscous ocellar triangle, compound eyes and maxillary palpi. Mandibles castaneous. No spots at posterior margin of occiput. Antennae fuscous except for basal 6 segments; with 37–38 flagellomeres.

*Thorax:* Pronotum pale yellow, with 2 anterior and 2 posterior fuscous spots; anterior spots more medially located than posterior pair. Mesonotum with light brown spot at base of each forewing. Metanotum pale yellow, without spots.

*Legs:* Pale yellow throughout, except foretibia occasionally with light brown infuscation at base or several small, dark brown spots.

*Forewing:* Yellow. Costal crossveins black along C and Sc margins, yellow in middle, 25–29 in number occasionally with many forked. Longitudinal veins pale yellow. Bases of radial forks and crossveins fuscous. Marginal and occasionally radial and medial cells with dark infuscations.

*Hind Wings:* Pale yellow; usually with the r crossveins and crossveins of apical field fuscous.

*Male Abdomen:* Pale yellow. Lateral, membranous pouches between 8th and 9th segments. 9th tergum clearly divided into 2 broad, triangular sclerites; with long lightly sclerotized processes anteriorly. 9th sternum almost rectangular, mesal division obsolescent; anterolateral angle produced into a straplike sclerite. 10th tergite approximately 5 times as long as wide, nearly straight. 9th gonostyles incurved, barely enlarged apicad, with a small, sclerotized point at apex. 10th gonostylus barely projecting, a small hirsute lateral lobe with inner margin barely differentiated from fused 10th gonocoxites.

BEST DOCUMENT AVAILABLE

*Forewing Length:* Male, 32–39 mm (avg. 34.4); female, 36–50 mm (avg. 43.5).

TEMPORAL DISTRIBUTION.—At the Universidade de São Paulo field station at Boraceia, many specimens have been collected between November and March. Specimens have been collected in the area around Rio de Janeiro from October to December and in May. The peak of emergence seems to be mid-summer in the Southern Hemisphere.

GEOGRAPHICAL DISTRIBUTION.—This species appears to be widespread in southeastern Brazil. Weele (1910) records it from Paraná, Espirito Santo, and Rio de Janeiro states, Stitz (1914) adds Santa Catarina, and we herein add definite records from Minas Gerais and São Paulo, all in Brazil. BRAZIL: no further data, 1♀, 3 without abdomen including holotype of *Neuromus winthemi* Davis (MCZ). *Espirito Santo*: ex coll. Fruhstorfer, 1♀ (MCZ). *Rio de Janeiro:* 3–5 [month unknown] 1935, Sandig, 2♀ (USNM, MCZ); Rio de Janeiro, Dec, 1 without abdomen (MCZ). Rio de Janiero, Teresopolis, Jul, Michaelis, 1♂ (MCZ). Itatiaia, Rio de Janeiro, 3 Feb 1963, Halik, 1♀ (USNM); Ilaliaya, Paraguay [undoubtedly Itatiaia, Brazil], Feb, F. Schade, 2♂ 1♀ (MCZ). *Minas Gerais:* 14 Nov 1900, Kennedy, holotype *C. meridionalis* Weele (RNH). *Santa Catarina:* Theresopolis, Fruhstorfer, 1♀ (MCZ). 1♀, det. *C. hieroglyphica* by Navás (ZSBS). *São Paulo*: Boraceia, Feb-Mar 1975, M. E. Faran, 3♀, 1 without abdomen (USNM); same, but Feb 1967, W. L. Brown, 2♀ (MCZ). UNKNOWN: Buenos Ayres [assuredly not from Buenos Aires, Argentina], Winthem, as *Corydalus punctata* Burmeister, 1 without abdomen (MCZ). Lacking all data, 2♀, 1 without abdomen, including holotype of *Hermes corripiens* Walker (BMNH, MCZ, ZSBS).

SPECIES RELATIONSHIPS.—This species and *C. plaumanni* form a distinctive group characterized by the lack of dark spots posteriorly on the head, black apical two-thirds of the antennae, and form of the male genitalia. The presence of a dark lateral margin on the head, the unspotted wings, and broader 10th gonocoxites of *C. plaumanni* readily distinguish it from *C. corripiens.*

### *Chloronia plaumanni*, new species

FIGURES 5, 14–16, 43–44

Holotype male is in the collection of the Naturhistorisches Museum Wien, Vienna.

DESCRIPTION.—Present description is based on three males, five females, and one without abdomen.

*Head:* Stramineous; fuscous stripe from rear margin of compound eye to posterior margin of occiput. Rugose anteriad to eyes. Ocellar triangle fuscous centrally. Antennae with basal 3 segments stramineous, fuscous beyond; with 46–53 flagellomeres.

*Thorax*: Pronotum stramineous with only anterior pair of fuscous spots. Meso- and metanota stramineous, without markings.

*Legs:* Stramineous; fore- and midtibiae only with a fuscous, basal spot. Last 4 tarsal segments infuscate.

*Forewing:* Stramineous, with crossveins fuscous. No dark bordering of crossveins nor spots in cells except a fuscous spot in 1st closed anal cell. Longitudinal veins stramineous.

*Hind Wing:* Stramineous throughout, except for 1st or 2nd *r*.

*Male Abdomen:* Stramineous. With small pouches between 8th and 9th segments laterally. 9th tergum divided into 2 broad, triangular sclerites; with moderately long, lightly sclerotized processes anteriorly. 9th sternum almost rectangular, mesal division obsolescent; anterolateral angles produced into a straplike sclerite. 10th tergite slightly curved, about 4 times as long as broad. 9th gonostyles incurved, apically inflated slightly, with a sclerotized apical tooth. 10th gonostylus a small, hirsute, rounded, lateral lobe borne from very broad, fused 10th gonocoxites.

*Forewing Length:* Male, 35–42 mm; female, 37–39 mm.

INTRASPECIFIC VARIATION.—The small sample examined by us is remarkably constant in appearance.

TEMPORAL DISTRIBUTION.—The male from Nova Teutônia was collected on 15 November 1949, and the three females in December 1931,

BEST DOCUMENT AVAILABLE

December 1939, and November 1976. A November-December adult emergence is thus indicated.

GEOGRAPHICAL DISTRIBUTION.—All known specimens have been collected in southern Brazil. Holotype, male: BRAZIL, *Rio Grande do Sul:* no further data, Stieglmayr, NMW type. Paratypes: same data, 1♂ 2♀, 1 without abdomen (NMW, USNM). *Santa Catarina:* Nova Teutônia (27°11′S, 52°23′W), 300–500 m, 15 Nov 1949, Fritz Plaumann, 1♂ (CFP); same, but Dec 1931, Dec 1939, Nov 1976, 3♀ (CFP).

SPECIES RELATIONSHIPS.—This species and *C. corripiens* form a very distinctive species group that is restricted to eastern Brazil. The dark lateral stripe on the head and lack of second pair of pronotal spots are diagnostic for *C. plaumanni.* In addition, the forewings lack the dark spotting, typical of *C. corripiens*, and the 10th gonocoxites are much broader in *C. plaumanni.*

This species is named after the collector, Mr. Fritz Plaumann, who has made great strides in bringing the entomofauna of the state of Santa Catarina to the attention of specialists.

### *Chloronia antilliensis* Flint

FIGURES 7, 17–19, 45

*Chloronia antilliensis* Flint, 1970:240.

Male holotype and female allotype are in the National Museum of Natural History.

DESCRIPTION.—Present description is based on eight males and 23 females.

*Head:* Pale yellow with fuscous ocellar triangle, apical half of mandibles, labial and maxillary palpi, and compound eyes. Two elongate, angular fuscous marks posteriorly on occiput. Antennae pale yellow, apical fourth infuscate; with 37–43 flagellomeres.

*Thorax:* Pronotum pale yellow with an anterior pair of elongate fuscous marks and a posterior pair of round spots. Mesonotum with 2 lateral fuscous spots, 2 mesal spots are generally lacking. Metanotum pale yellow throughout.

*Legs:* Pale yellow. Tibia of fore- and often midleg with a basal dark spot, all legs with a dark spot at junction of tibia and basal tarsomere; apical tarsomeres generally infuscate.

*Forewing:* Yellow. Costal crossveins pale through centers, apices infuscate; 29–35 in number. Longitudinal veins pale. Most crossveins fuscous; with light fuscous spots in anterior cells, usually centered on crossveins; anal and apical cells usually with dark marks.

*Hind Wing:* Pale yellow; rarely with 2nd r fuscous.

*Male Abdomen:* Pale yellow. 9th tergum trianguloid with a small patch of enlarged, spinous hairs. 9th sternum with a small trianguloid lobe from posterior margin. 10th tergite elongate, parallel sided, nearly straight. 9th gonostylus incurved, inflated apicad, with a sclerotized apical point. 10th gonostylus a rounded lobe about as long as broad, widely separated mesally, connected by a narrow bandlike 10th gonocoxite.

*Forewing Length:* Male, 28–34 mm (avg. 30.9); female, 31–43 mm (avg. 37.9).

INTRASPECIFIC VARIATION.—Other than the considerable variation in size, the dark spots in the cells of the forewing vary considerably in intensity. Rarely only a few basal spots are visible, but generally most are indicated, even if only faintly.

TEMPORAL DISTRIBUTION.—Adults were collected only between 11 April and 15 June, in spite of collecting during most of the year in the same areas. Males were taken from 11 April to 6 May, and females were taken from 14 April to 15 June, an indication that the males may emerge slightly before and for a shorter period than the females, which probably live longer.

GEOGRAPHICAL DISTRIBUTION.—All known examples were collected on the Lesser Antillean island of Dominica, with full collection data given in Flint, 1970. A species of this genus, probably *C. antilliensis*, was reported verbally by Mr. J. Bonfils to occur on the adjacent island of Guadeloupe.

SPECIES RELATIONSHIPS.—The relationships of this species are rather puzzling. The presence of the typical dark spot posteriorly on the head distinguish it from the *corripiens* group. It still has

BEST DOCUMENT AVAILABLE

the basically primitive form of ninth sternum, gonostylus, and 10th tergite. The short and rounded 10th gonostylus is probably also a rather primitive condition. The presence of a patch of spinous setae on the ninth tergum is a distinct specialization, however. It would, therefore, appear to be the most unspecialized member of the spotted-head group and not closely related to any other known species.

### *Chloronia banksiana*, new species

FIGURES 7, 20–22, 47

*Chloronia bogotana* [not Weele].—Banks, 1943:65.

Male holotype, by present designation, is from Venezuela and is in the Museum of Comparative Zoology, Harvard University.

DESCRIPTION.—Present description is based on three males and two females.

*Head:* Rugose anteriad to ocelli. Yellow orange, with ocellar triangle, maxillae, and palpi fuscous; mandibles castaneous. With 2 dark spots at each side of posterior of occiput. Antennae yellow, grading into fuscous for apical fourth; of about 45 flagellomeres.

*Thorax:* Pronotum yellow orange, with 2 elongate black marks each side. Mesonotum with 2 mesal and 2 lateral fuscous spots.

*Legs:* Yellow orange; foretibia without spot; apical tarsal segment of all legs variably infuscate.

*Forewing:* Intense, waxy, lemon yellow. Costal crossveins mostly fuscous; basal 4–5 often partially pale; next 13–15 veins fuscous, apical 10–12 veins yellow. Longitudinal veins pale, with some forks infuscate; all crossveins and terminal veinlets fuscous. Radial and medial cells with dark marks at bases and apices of cells; strongly spotted near wing base. Marginal cells with median longitudinal marks, especially in anal and cubital areas.

*Hind Wing:* Yellow, except crossvein 2nd *r* fuscous, and apical veins and crossveins variably infuscate.

*Male Genitalia:* 9th tergum deeply divided anteromesally. 9th sternum divided mesally, posterior margin of sternite produced into a short, triangular mesal lobe. 10th tergite elongate, straight, about 5 times as long as wide. 9th gonocoxite elongate, cylindrical. 9th gonostylus incurved, evenly inflated apicad, with an apical tooth. 10th gonostylus cylindrical, about 4 times as long as broad, separated mesally by a bandlike gonocoxite, which is expanded laterad.

*Forewing Length:* Male, 32–33 mm; female, 35–38 mm.

INTRASPECIFIC VARIATION.—The series is quite constant in color and size.

TEMPORAL DISTRIBUTION.—Specimens have been taken from 15 February to October (Banks, 1943), but most dates are clustered around late April and May.

GEOGRAPHICAL DISTRIBUTION.—The species is known only from Venezuela, and all the localities that can be located with certainty are from the northern coastal ranges. Holotype, male: VENEZUELA [estado unknown], Guaquira, 5 May, Anduze. MCZ 32,582. Paratypes: same data, 2♂ (MCZ, USNM). [Edo. Carabobo], Borb[urata], Northern Range, 15 Feb 1942, Lichy, 1♀ (MCZ). [Edo. Aragua], Maracay, Rancho Grande, 1100 m, Vogelsang, 1♀ (ZSBS).

SPECIES RELATIONSHIPS.—This is a member of the *hieroglyphica* group, probably most closely related to *C. bogotana*. Due to the loss of the genitalia of the type, and only known specimen, of the latter species, it is rather difficult to assess the exact relationships between the two. *Chloronia banksiana* may be recognized by the more rugose head and more distinctly marked forewings of an intense, waxy, lemon-yellow color.

This species is dedicated to Mr. Nathan Banks for his many contributions to neuropterology.

### *Chloronia bogotana* Weele

FIGURES 8, 23, 24, 46

*Chloronia bogotana* Weele, 1909:253.

Male holotype is in the Leyden Museum.

DESCRIPTION.—Present description is based on the holotype male.

BEST DOCUMENT AVAILABLE

*Head:* Smooth and shining anteriad to antennae. Reddish yellow with concolorous ocellar triangle; mandibles reddish brown, teeth darker along margins; maxillary palpi fuscous. A dark spot at posterior margin of occiput continued anteriad as a narrow dark line. Antennae pale yellow shading to fuscous at apex; with 33–35 flagellomeres.

*Thorax:* Pronotum pale yellow, with 2 anterior and 2 posterior fuscous spots. Mesonotum with 2 medial and 2 lateral fuscous spots. Metanotum pale yellow, without spots.

*Legs:* Pale yellow, apical tarsal segment darker; foretibia with a fuscous spot basolaterally.

*Forewing:* Yellow. Costal crossveins black, 24–26 in number. Longitudinal veins pale yellow, except base of some radial forks and marginal forks of all veins fuscous. Base of radial sector and all crossveins fuscous. Most radial and medial cells with a fuscous spot at base and distal margin of cell. Posterior marginal cells each with 1 fuscous spot.

*Hind Wing:* Wholly pale yellow, except 2nd *r* fuscous.

*Male Abdomen:* Pale yellow. 9th tergum truncate; becoming bifurcate posteriorly. 9th sternum quadrangular, slightly more elongate laterally. 10th tergite elongate, curved medially, approximately 8 times as long as broad. 9th gonostyles stout, incurved and apically inflated, with a small, heavily sclerotized distal tooth. Fused 10th gonocoxites a transverse band, and 10th gonostyles forming a medial acute point and lateral elongate projections. Aedeagus membranous.

*Body Length:* Male, head and thorax only 16 mm.

*Forewing Length:* Male, 36 mm.

Temporal Distribution.—Navás (1928b) recorded a specimen collected in March.

Geographical Distribution.—The type specimen was collected at Bogota, Colombia, and Stitz (1914) recorded 2♀ from Cauca, Colombia. Navás (1928b, 1928c) reported further specimens from Villavicencio, Colombia, and Riobamba-Macas, Ecuador. We have not found any additional specimens of this species and consider the subsequent records of this species suspect.

Notes on Type.—The lack of a dark mark in the ocellar triangle may be an artifact due to separation of the tissues from the cuticle. The eyes are also pale, clearly due to this factor. The type has had the genitalia removed, but unfortunately they can not now be found. The presence of a dark triangular central point on the gonocoxites shown in the original figure (herein reproduced as Figure 23) is probably an artifact of preservation. Unfortunately, with the loss of the genitalia and lack of additional material, we can not determine the true situation.

Species Relationships.—Based on the originally published figures of the male genitalia, and ignoring the triangular central mark, this species and *C. banksiana* must be virtually identical. The type of *C. bogotana* has a smooth, shining head anteriad to the antennae and diffuse marks in the cells of the forewings, which are not strongly spotted basally.

### *Chloronia hieroglyphica* (Rambur)

Frontispiece, Figures 2–4, 8, 25–27, 48

*Neuromus hieroglyphica* Rambur, 1842:442.
*Hermes hieroglyphicus.*—Walker, 1853:206.
*Corydalis hieroglyphicus.*—Hagen, 1861:194.
*Chloronia hieroglyphica.*—Banks, 1908:30.

Male holotype from Cayenne is in the Selys collection in Brussels, and was not seen.

Description.—Present description is based on 10 males and 30 females, pinned.

*Head:* Pale yellow with fuscous ocellar triangle, compound eyes, distal half of mandibles, and maxillary palpi. Two additional dark spots at posterior margin of occiput. Antennae pale yellow shading to fuscous at apex, with 43–45 flagellomeres.

*Thorax:* Pronotum pale yellow, with 2 anterior and 2 posterior fuscous spots. Mesonotum with 2 medial and 2 lateral fuscous spots.

*Legs:* Pale yellow throughout.

*Forewing:* Yellow. Costal crossveins black, 27–

BEST DOCUMENT AVAILABLE

30 in number with several forked. Longitudinal veins pale yellow, except base of some radial forks and marginal forks of all veins fuscous. Base of radial sector and all crossveins fuscous. Most radial and medial cells with a fuscous mark at basal and distal margin of cell. Posterior marginal cells each with 1 fuscous spot.

*Hind Wing:* Wholly pale yellow, except 2nd *r* fuscous.

*Male Abdomen:* Pale yellow. 9th tergum deeply divided anteromesally. 9th sternum quadrangular. 10th tergite elongate, slightly curved mesally, approximately 4 times as long as broad. 9th gonostyles stout, incurved, broadest before apex, which gently tapers to a strong apical tooth. 10th gonostyles 2 thin, elongate, caudally directed projections, broadened at midlength, and connected anteromesally by fused 10th gonocoxites.

*Forewing Length:* Male, 23–25 mm (avg. 24.0); female, 24–30 mm (avg. 26.5).

Intraspecific Variation.—There appears to be a considerable amount of variation in forked costal crossveins. Live specimens are bright lemon yellow, which fades slowly after death to a stramineous color.

Temporal Distribution.—This species appears to emerge from October to early February in the central Amazon region, with a peak emergence in mid-November; however, a few females have been collected in June, July, or August, indicating a possible sporadic emergence at other times of the year or a longer life for this sex.

Geographical Distribution.—This species has been recorded from Cayenne (Rambur, 1842), Argentina, Brazil, Venezuela (Hagen, 1861), and Panama (Stitz, 1914). Many of these older records undoubtedly refer to other species, and the true distribution is probably confined to northern and central South America. Records for this species that we have seen are: Brazil, *Amazonas:* Reserva Ducke (km 26-AM010), 6 Nov 1976, Penny and Dantas, 2♀; same, but 11 Nov 1976, 3♂ 2♀; same, but 18 Nov 1978, 1♂; same, but 24 Nov 1976, 1♂ 1♀; same, but 1–5 Feb 1979, O. S. Flint, Jr., 1♀ (INPA, MZ-USP, USNM). ceplac, Km 30-AM010, 18, 19 Aug 1977, L. P. de Albuquerque, 1♀; same, but 13 Oct 1977, I. Gorayeb, 2♂; same, but 1 Jun 1979, J. R. Arias, 1♀ (INPA, CIG). Estrada AM010, km 190, 25 Oct 1965, F. Almeida, 1♀ (INPA). Estrada BR174, km 60, 14 Jan 1976, N. D. Penny, 1♂ (INPA). Carauari on Rio Jurua, 23 Sep–7 Oct 1980, F. Barbosa, 1♂ (INPA). Manaus, 16 Nov 1976, A. Anderson, 1♀ (INPA). *Pará:* Rodovia Belém-Brasilia, km 75, Mar 1959, J. Hiohsi, 1♂ (MPEG). French Guiana: St. Jean, Jul, W. Schaus, 1♀ (USNM). Guyana, *Essequibo:* 39 mi SW, Wineperu, Mazaruni River, 17, 18 Mar 1969, Duckworth and Dietz, 1♀ (USNM). Peru, *Loreto:* Callicebus Res. Station, Mishana, Rio Nanay, 25 km SW. Iquitos, 120 m elev., 10–17 Jan 1980, J. B. Heppner, 17♀ (USNM). *Madre de Dios:* Rio Tambopata Res., 30 air km SW. Puerto Maldonado, 290 m elev., 21–25 Nov 1979, J. B. Heppner, 1♂ (USNM).

Species Relationships.—This species appears to be the most specialized of its group. Like its relatives, *C. bogotana* and *C. banksiana*, it retains the primitive 10th tergite and ninth sternum, but has a more specialized, shouldered, 10th gonostylus and an attenuate ninth gonostylus.

### *Chloronia mirifica* Navás

Figures 9, 28–30, 49, 50

*Chloronia mirifica* Navás, 1925:195.
*Chloronia hieratica* Navás, 1928a:11, 12. [New synonymy.]

Male and female syntypes of *C. mirifica* are missing from the Navás collection and are presumed to be lost. The neotype, herein designated, is in the National Museum of Natural History. The male holotype of *C. hieratica* is in Stockholm, Sweden, and has been studied.

Description.—The present description is based on the types and eight males and 10 females.

*Head:* Pale yellow with fuscous ocellar triangle, compound eyes, distal half of mandibles, labial and maxillary palpi. Two additional fuscous spots at posterior margin of occiput. Antennae pale yellow, shading into dark brown on apical fourth; with 36–55 flagellomeres.

BEST DOCUMENT AVAILABLE

*Thorax:* Pronotum pale yellow, with 2 anterior and 2 posterior fuscous spots. Mesonotum with 2 medial and 2 lateral fuscous spots. Metanotum pale yellow throughout.

*Legs:* Pale yellow, apical tarsal segment variably infuscate.

*Forewing:* Yellow. Costal crossveins 23–31 in number, rarely with 1 forked; 2–5 yellow in middle, 1 and 6 to about 20 black, apical veins pale. Longitudinal veins pale yellow, except for forks, apical veinlets, and part of radial sector fuscous. All crossveins mostly fuscous. Some posterior radial cells, and all medial cells with dark spots at base and apical margins. Posterior marginal cells each with an elongate dark mark.

*Hind Wing:* Wholly pale yellow except 2nd *r* and adjacent Rs infuscate.

*Male Abdomen:* Pale yellow. 9th tergum deeply divided anteromesally. 9th sternum with anterolateral angle somewhat produced and with an elongate lobe from posterior margin. 10th tergites long, directed posteriad, approximately 7 times as long as broad basally. 9th gonostylus incurved, inflated apicad, with a heavily sclerotized distal point and a tuft of long hairs. 10th gonostylus elongate, trianguloid, about as long as or longer than broad, ending in an apical point.

*Forewing Length:* Male, 29–40 mm (avg. 33.4); female 25–42 mm (avg. 32.8).

Intraspecific Variation.—There is a large variation in size in this species; however, it does not seem to be correlated with location. The 10th gonostyli are also somewhat variable, the types of *C. mirifica* and *C. hieratica* representing the two extremes in the degree that their tips are drawn out.

Temporal Distribution.—The specimens from Mexico and Guatemala in the northern part of the range have been taken in most of the warmer months of the year—May, June, August, September, October. The only dates for Costa Rica and Panama are in May, and the Colombian specimen was taken in January. Thus, there would appear to be a tendency for the flight season to be earlier in the year farther to the south.

Geographical Distribution.—The lost types of *C. mirifica* were from Costa Rica, Peralta and [Aguas] Zarcas. The neotype designated herein is from Juan Vinas, Costa Rica, a locality only about 20 km from Peralta. The type of *C. hieratica* is from Sliquino, Ecuador, Or[iental], a location we are unable to find in any gazetteer. The species appears to be distributed from Mexico to northern Peru.

We have seen specimens from the following localities. Mexico, *Veracruz:* Arroyo Claro, Santa Marta, Los Tuxtlas, 23, 24 Aug 1976, 2♂ 1♀; same, but 20 May 1976, P. Sanchez, 1♂ (USNM, UNAM). Balsapote, Los Tuxtlas, 8 Sep 1977, J. Bueno-S., 2♀ (USNM, UNAM). Los Tuxtlas, Jun 1968, M. Rosas, 1♀ (UNAM). Chicontepec, 14 Oct 1975, J. Bueno-S., 1♂ (USNM). Guatemala, *Solola:* Olas de Moka, 3000 ft elev., Sep 1908, G. P. Englehardt, 1♀ (MCZ). Costa Rica. *Cartago:* Tuis, N. Banks, 1♀ (MCZ). Juan Vinas, May, W. Schaus, 2♂ including neotype of *C. mirifica*, USNM 100,000. Panama, *Chiriqui:* Lino, Fassl, 1♀ (MCZ). Chiriqui, 1♀ (ZSBS). Bugaba, W. Schaus, 1♂ (MCZ). *Colon:* Santa Rita Ridge, 300 m elev., Thurman and Ratcliffe, 1♂ 2♀ (INPA). Colombia, *Meta:* Villavicencio, 450 m elev., Jan, Fassl, 1♂ (MCZ). Ecuador: Or[iental], Sliquino, ♂ holotype of *C. hieratica* (NRS). Peru, *Huanuco:* Monson Valley, Tingo Maria, 2 Nov 1954, Schlinger and Ross, 1♀ (CAS).

Species Relationships.—The species appears to be the most primitive of the group of species with modified ninth sterna. In *C. mirifica* the lateral angle is hardly produced, but there is a distinct hirsute process from the posterior margin. The tenth tergites are distinctly elongate, and the tenth gonostyli are modified into triangular lobes.

### *Chloronia gloriosoi*, new species

Figures 10, 31–33, 51

Male holotype, by present designation, is from Panama and is in the National Museum of Natural History.

Description.—Present description is based on 13 males and two females, pinned from alcohol.

BEST DOCUMENT AVAILABLE

*Head:* Smooth and shining anteriad to ocelli. Yellow orange, with ocellar triangle and palpi fuscous; mandibles castaneous. Generally with a long, angular dark mark at posterior margin of occiput, mark rarely broken into 2 spots. Antennae pale yellow shading into fuscous for apical fourth; of about 45 flagellomeres.

*Thorax:* Pronotum yellow orange; with 2 elongate fuscous marks on each side. Mesonotum with 2 mesal and 2 lateral dark spots. Metanotum unmarked.

*Legs:* Pale yellow; foretibia with a dark spot basolaterally.

*Forewing:* Yellow. Costal crossveins mostly fuscous; basal 4 veins each with a pale region, next 14–15 veins wholly fuscous, terminal 9–11 veins pale. Longitudinal veins yellow, some forks slightly infuscate; tips of apical veinlets fuscous. Radial and medial cells with dark marks at bases and apices of cells. Marginal cells with median longitudinal marks, especially in anal and cubital area.

*Hind Wing:* Pale yellow, except 2nd *r* fuscous.

*Male Abdomen:* Pale yellow. 9th tergum deeply divided mesally; with 2 small diffuse patches of spinous hair. 9th sternite with posterolateral angle prolonged, visible from dorsum as a trianguloid lobe, with another trianguloid lobe submesally from posterior margin. 10th tergite long, straight; with a short row of spinous hair basally. 9th gonocoxite elongate, cylindrical. 9th gonostylus incurved with a swollen basolateral angle, distal tooth displaced to inner apical angle. 10th gonostylus cylindrical, about 2½ times as long as broad, widely separated mesally, connected by a narrow, bandlike gonocoxite, which is broadly expanded laterally.

*Forewing Length:* Male, 39–45 mm (avg. 41.5); female, 42–44 mm (avg. 43).

Intraspecific Variation.—The series seems to very constant in color and size.

Temporal Distribution.—Dr. Wolda (pers. comm.) stated: "In the climatologically almost non-season tropics of Fortuna, this species is among the most seasonal. Adults are only found from late April until mid-June, and that in 3 consecutive years. I do not know what the environmental clues are that trigger this seasonality."

Geographical Distribution.—The species is presently known only from northern Panama. Holotype, male: Panama, *Chiriqui Prov.:* Fortuna Dam site, 14 May 1979, H. Wolda. USNM 100,001. Paratypes: same data, but 24 Apr 1979, 1♀; same, but 11 May 1978, 1♂; same, but 16 May 1978, 1♂; same, but 18 May 1979, 3♂; same, but 23 May 1979, 1♂; same, but 24 May 1979, 1♂; same, but 25 May 1979, 1♀; same, but 28 May 1979, 1♂; same, but 2 Jun 1979, 1♂; same, but 11 Jun 1979, 1♂; same, but 17 Jun 1979, 1♂; same, but 19 Jun 1979, 1♂.

Species Relationships.—This species is probably most closely related to *C. mexicana* but also shows similarities to *C. mirifica.* With the latter species, it shares the simple elongate 10th tergites. With the former, it agrees in the presence of three sets of spinous setae on the ninth and 10th terga and the bilobate ninth sterna. The form of the ninth and 10th gonostyli are distinctly specialized in this species.

We dedicate this species to Mr. Michael J. Glorioso, a most promising student of the Megaloptera, who died suddenly in October, 1980.

### *Chloronia pallida* (Davis)

Figures 9, 37–39, 53

*Neuromus pallidus* Davis, 1903:470.
*Corydalus pallidus.*—Weele, 1910:16.
*Chloronia pallida.*—Penny, 1977:7.

Holotype, questionably from Mexico, is in the National Museum of Natural History.

Description.—Present description is based on the holotype and a male, pinned.

*Head:* Pale yellow; ocelli rimmed centrally with fuscous; mandibular teeth edged with fuscous; type with narrow elongate dark marks on posterior of occiput (male lacking these marks). Antennae pale yellow; with 39–40 flagellomeres.

*Thorax:* Pronotum pale yellow, with 2 elongate anterior and 2 posterior spots. Meso- and metanotum wholly pale yellow.

BEST DOCUMENT AVAILABLE

*Legs:* Pale yellow throughout.

*Forewing:* Yellow. Costal crossveins 25–27 in number. Longitudinal veins pale yellow. Costal crossveins pale through centers, darkened slightly at apices. Crossveins in anterior half of wing indistinctly infuscate. No markings in cells.

*Hind Wing:* Wholly pale yellow.

*Male Abdomen:* Pale yellow. 9th tergum trianguloid, with a spot of enlarged, modified hairs and scattered enlarged setae near base of 10th tergites. 9th sternum with posterolateral angle and posteromesal angles produced into elongate lobes. 10th tergites elongate, with a few scattered enlarged setae basad; apex curled, generally mesad. 9th gonocoxites incurved, inflated apically with a heavily sclerotized distal point. 10th gonostyli forming rounded lobes about as long as wide, widely separated mesally, connected by narrow, bandlike fused gonocoxites.

*Forewing Length:* Male, 29 mm.

Intraspecific Variation.—The type clearly possesses a pair of elongate markings on the head, which are lacking in the male.

Temporal Distribution.—A male from Mexico was collected on 1 August.

Geographical Distribution.—The type is marked as being questionably from Mexico; however, another male was collected from Mexico, *Morelos:* route 95, km 91, near Xochitepec, 1 Aug 1965, O. S. Flint, Jr., in the National Museum of Natural History.

Species Relationships.—This is very closely related to *C. mexicana* and may, in fact, be no more than a color variety of it. The genitalia in the two species do not seem to offer any valid differences, even though the 10th gonostyli in *C. pallida* are a bit shorter than in *C. mexicana*; however, the coloration, especially the pale antennae in *C. pallida*, offers easy recognition. For this reason we are retaining *C. pallida*, pending more material and a better understanding of the true relationship of the two forms.

### *Chloronia mexicana* Stitz

Figures 10, 34–36, 52

*Chloronia mexicana* Stitz, 1914:199.

Male holotype from Mexico is in the Zoologisches Museum, Humboldt University, Berlin, and was not seen.

Description.—Present description is based on 13 males and 18 females.

*Head:* Pale yellow with ocellar triangle, compound eyes, distal third of mandibles, and apical segments of maxillary and labial palpi fuscous. Two additional fuscous spots at posterior margin of occiput. Antennae pale yellow, apical two-thirds infuscate; with 42–45 flagellomeres.

*Thorax:* Pronotum pale yellow with 2 anterior and 2 posterior elongate, fuscous spots. Mesonotum with 2 median and 2 lateral fuscous spots. Metanotum yellow throughout.

*Legs:* Pale yellow, tibia of fore- and midlegs with a basal dark spot, all legs with a dark spot at junction of basal tarsomere with tibia, apical tarsomeres variably infuscate.

*Forewing:* Yellow. Costal crossveins mostly yellow except 1–3 and often apices of following ones infuscate; 30–35 in number, rarely 1 or 2 forked. Longitudinal veins pale yellow, rarely some forks and tips of apical veinlets fuscous. All crossveins fuscous. Occasionally with some indistinct longitudinal infuscations in center of medial cells. Marginal cells in anal region each with an elongate dark mark.

*Hind Wing:* Wholly pale yellow except 2nd *r* infuscate. Rarely with infuscation of apical veins and anal veins near their midlength.

*Male Abdomen:* Pale yellow. 9th tergite quadrangular, with 2 small spots of enlarged, spinous hairs. 9th sternite with posterolateral angle greatly prolonged and visible from the dorsum as a narrowly trianguloid lobe, with a shorter trianguloid lobe from the posterior margin. 10th tergite elongate, base slightly inflated with a small spot of enlarged, spinous hairs, apex narrowed and curled, generally dorsad. 9th gonocoxite elongate, cylindrical. 9th gonostylus incurved and inflated apicad and basad, with a heavily sclerotized distal point. 10th gonostylus cylindrical about 1½ times as long as broad, widely separated mesally, connected by a narrow bandlike gonocoxite.

BEST DOCUMENT AVAILABLE

*Wing Length:* Male, 28–37 mm (avg. 31.2); female 30–45 (avg. 34.4).

INTRASPECIFIC VARIATION.—There is variation in the degree of development of the markings in the cells. There often are no apparent marks, except in the anal cells, whereas other examples show, rather faintly, longitudinal streaks.

TEMPORAL DISTRIBUTION.—The species has been taken as early as 24 April and as late as 5 August, but most records are from May and June.

GEOGRAPHICAL DISTRIBUTION.—The species has been taken only in Mexico and Guatemala. Records for examples we have seen are: MEXICO, *Tamaulipas:* Río Corona, 18 mi N Ciudad Victoria, 3 Jun 1978, Gillaspy et al., 4♂ 3♀ (TAI). *San Luis Potosi:* El Salto, 26 mi W of Antiguo Morelos, 11–14 Jul 1963, Duckworth and Davis, 2♀ (USNM); same, but 11 Jul 1961, Univ. Kans. Mex. Exp., 1♂, 1♀ (SEM); same, but 19 Jul 1962, 1♂, 2 without abdomen (SEM); same, but 21 Jul 1962, Naumann, Ordway, and Roberts, 1 without abdomen (SEM); same, but 4 Sep 1962, Ordway and Marston, 2♀ (SEM); same, but 16 Jul 1963, Univ. Kans. Mex. Exped., 2♂ (SEM); Palitla, 25 Jun 1965, O. S. Flint, Jr., 2♂ 3♀ (USNM); same, but 5 Aug 1966, 1♀ (USNM). *Veracruz:* Cuitlahuac, 24–27 Jul 1965, Flint and Ortiz, 1♀ (USNM); Puente Nacional, 23, 24 Jul 1965, Flint and Ortiz, 1♂ (USNM); Cordoba, May 1906, Wm. Schaus, 1♀ (USNM); same, but 8 Jul 1961, D. H. Janzen, 1♀ (CAS). *Chiapas:* [no further data], 1♀ (USNM); Palenque, 2 Apr 1951, G. Fairchild, 1♀ (MCZ); Agua Azul (near Palenque), May 1978, C. R. Beutelspacher, 2♂ (UNAM). GUATEMALA [*Alta Verapaz*]: Trece Aguas, 24 Apr 1914, 1♀ (USNM). *Suchitepequez:* W of Samayac, 11 Jun 1966, Flint and Ortiz, 1♀ (USNM).

SPECIES RELATIONSHIPS.—This, the northernmost species of the genus, is closely related to *C. pallida*, as outlined under that species. The two are a specialized counterpart of *C. gloriosoi*, in which the 10th tergites are curled, but the unmodified ninth and 10th gonostyli are retained. The coloration of *C. mexicana* is also specialized through loss or great reduction of the typical markings in the forewing cells and infuscation of the apical two-thirds of the antennae.

BEST DOCUMENT AVAILABLE

# Literature Cited


Banks, N.

1908. On the Classification of the Corydalinae, with Description of a New Species. *Proceedings of the Entomological Society of Washington*, 10:27–30.

1943. Neuroptera of Northern South America. *Boletin de Entomologia Venezolana*, 2:59–66, 3 figures.

Davis, K. C.

1903. Sialidae of North and South America. *New York State Museum Bulletin*, 68:442–486, figures 20–25, plates 51, 52.

Flint, O. S., Jr.

1970. The Megaloptera of Dominica. *Proceedings of the Entomological Society of Washington*, 71:240–242, 5 figures.

Glorioso, M. J.

1981. Systematics of the Dobsonfly Subfamily Corydalinae (Megaloptera: Corydalidae). *Systematic Entomology*, 6:253–290, 63 figures.

Gorayeb, Inocêncio, and R. R. Pinger

1978. Detecção de predadores naturais das larvas de *Simulium fulvinotum* Cerq. e Mello, 1968 (Diptera: Nematocera). *Acta Amazonica*, 8(4):629–637, 1 figure, 3 tables.

Hagen, H. A.

1861. Synopsis of the Neuroptera of North America, with a List of the South American Species. *Smithsonian Miscellaneous Collections*, 4(1):xx+1-347.

McLachlan, R.

1869. Considerations on the Neuropterous Genus *Chauliodes* and Its Allies; with Notes and Descriptions. *Annals and Magazine of Natural History*, series 4, 4: 35–46.

Navás, Longinos

1925. Insectos exoticos nuevos o poco conocidos, Segunda Serie. *Memorias de la Real Academia de Ciencias y artes de Barcelona*, series 3, 19:181–200, figures 13–24.

1928a. Insectos del Museo de Estocolmo. *Revista de la Real Academia de Ciencias Exactas, Fisicas y Naturales de Madrid*, 24:1–12, 6 figures.

1928b. Insectos neotropicos, 4ª Serie. *Revista Chilena de Historia Natural*, 32:106–128, figures 16–24.

1928c. Insectos del Museo de Hamburgo, Primera Serie. *Boletin de la Sociedad Entomologica de Espana*, 11:59–67, 90–100, 121–138, 19 figures.

1934. Insectos Suramericanos, Octava Serie. *Revista de la Academia de Ciencias de Madrid*, 31:9–28, figures 19–39.

Penny, Norman D.

1977. Lista de Megaloptera, Neuroptera e Raphidioptera do Mexico, America Central, ilhas Caraibas e America do Sul. *Acta Amazonica*, 7(4)(supplement):1–61.

Rambur, J. P.

1842. *Histoire naturelle des insectes: Nevropteres*. 534 pages. Paris.

Stitz, J.

1914. Sialiden der Sammlung des Berliner Museums. *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin*, 1914(5):191–205, 12 figures, plates VI-VII.

Walker, F.

1853. *List of the Specimens of Neuropterous Insects in the Collection of the British Museum, Part II*: (*Sialides-Nemopterides*). Pages 193–476. London: British Museum.

1858. Characters of Undescribed Neuroptera in the Collection of W. W. Saunders. *Transactions of the Royal Entomological Society of London*, new series, 5:176–199.

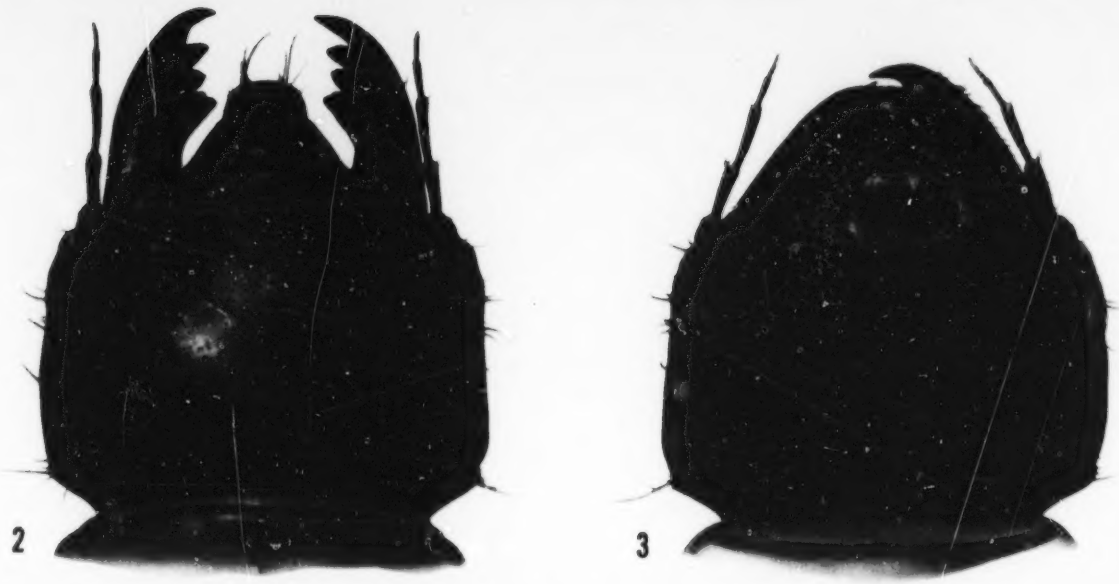
Weele, H. W. van der

1909. New Genera and Species of Megaloptera Latr. *Notes from the Leyden Museum*, 30:249–264.

1910. Megaloptera (Latreille) Monographic Revision. In *Collections Zoologiques du Baron Edm. de Selys Longchamps*, 5(1):1–93, 70 figures, 4 plates.




BEST DOCUMENT AVAILABLE




FIGURES 2, 3.—*Chloronia hieroglyphica:* 2, larval head, dorsal; 3, larval head, ventral.

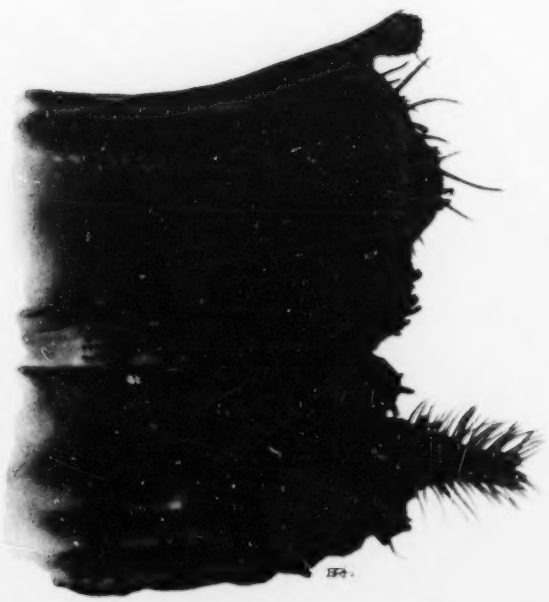


FIGURE 4.—*Chloronia hieroglyphica:* portion of metanotum and first abdominal tergum of larva.

BEST DOCUMENT AVAILABLE

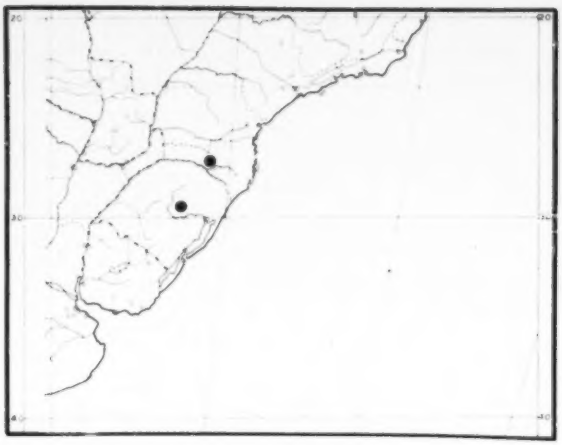


FIGURE 5.—Distribution of *C. plaumanni*.

FIGURE 6 (right).—Distribution of *C. corripiens*.

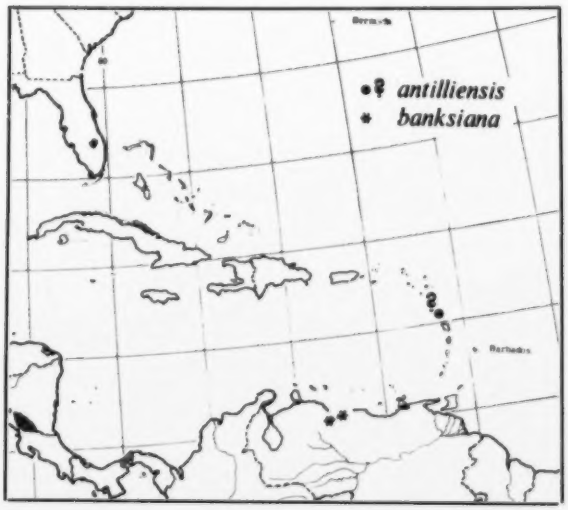



FIGURE 7.—Distributions of *C. antilliensis* and *C. banksiana*.

BEST DOCUMENT AVAILABLE

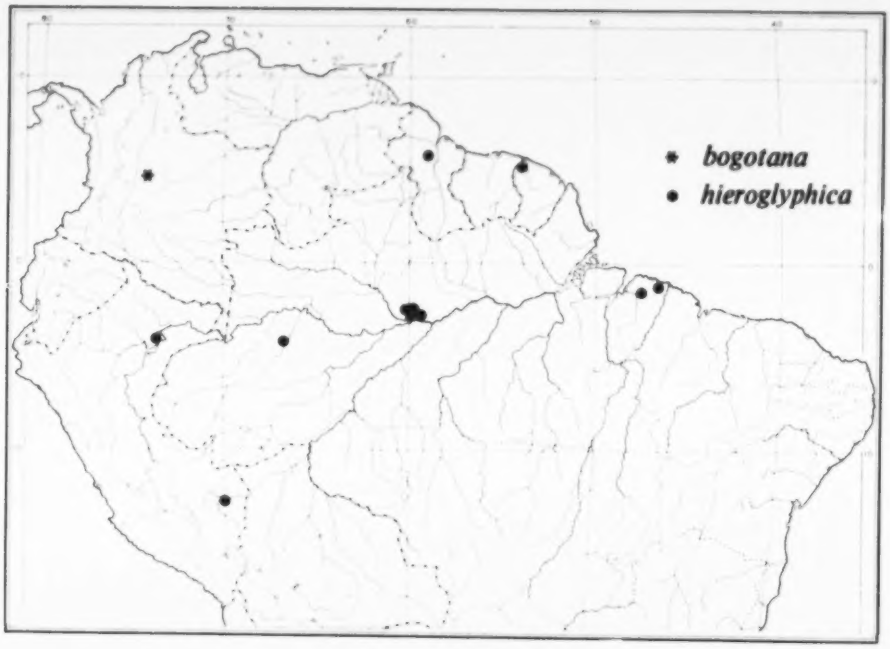



FIGURE 8.—Distributions of *C. hieroglyphica* and *C. bogotana*.

FIGURE 9.—Distributions of *C. mirifica* and *C. pallida*.

BEST DOCUMENT AVAILABLE

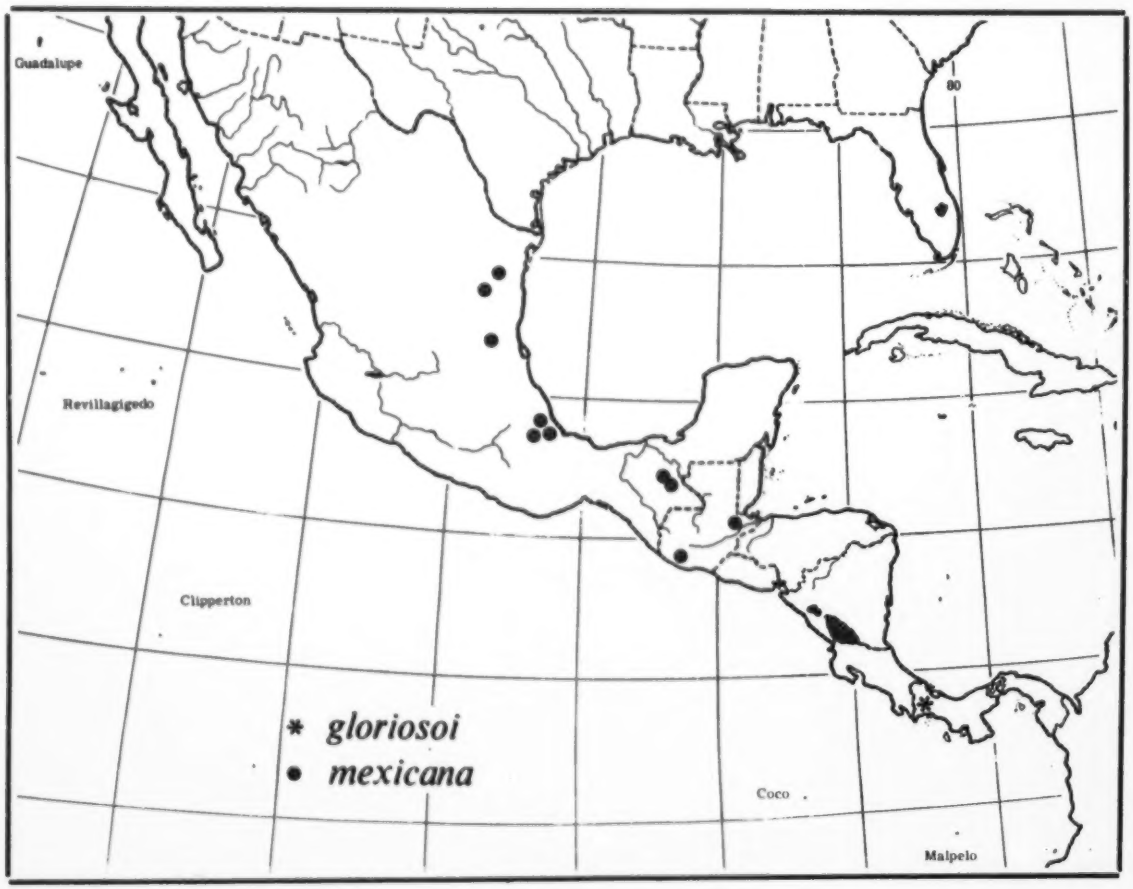
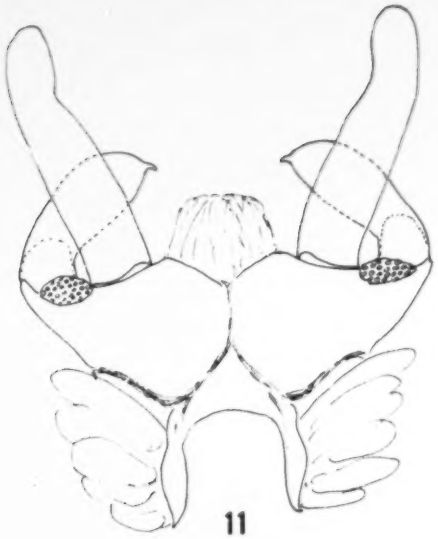
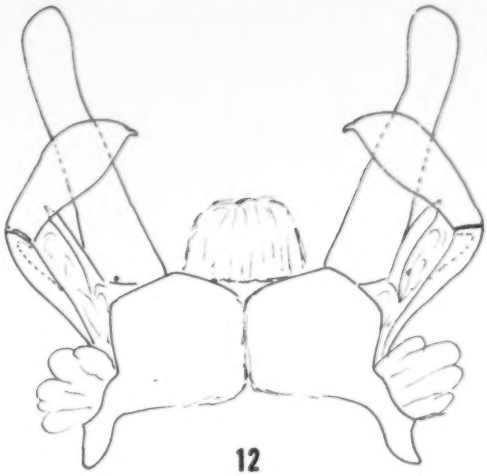
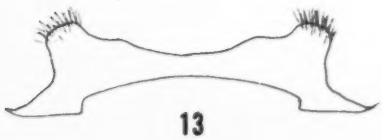


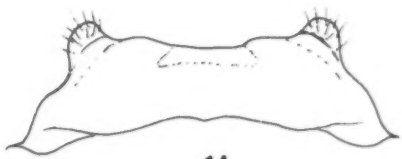

FIGURE 10.—Distributions of *C. mexicana* and *C. gloriosoi*.

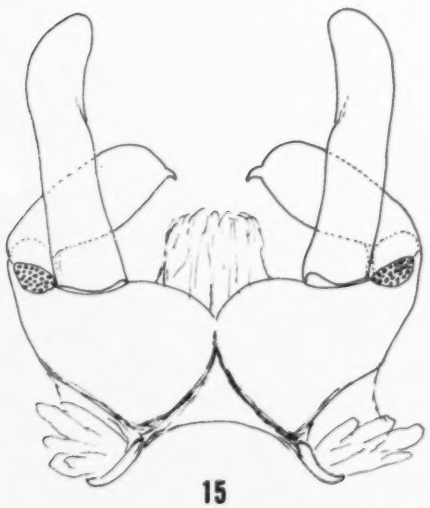
BEST DOCUMENT AVAILABLE

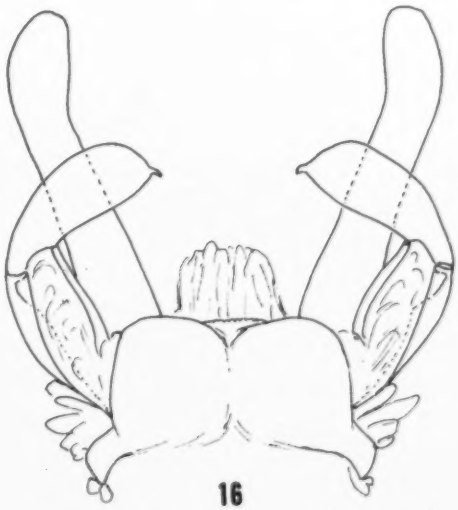


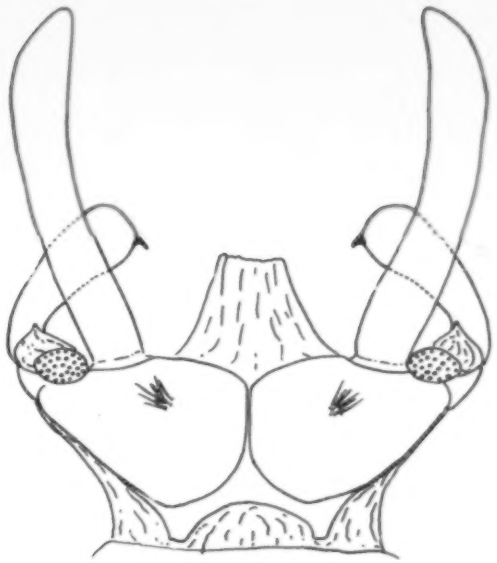




FIGURES 11–16.—*Chloronia corripiens:* 11, male genitalia, dorsal; 12, male genitalia, ventral; 13, tenth gonostyli and gonocoxites, ventral. *Chloronia plaumanni:* 14, tenth gonostyli and gonocoxites, ventral; 15, male genitalia, dorsal; 16, male genitalia, ventral.

BEST DOCUMENT AVAILABLE



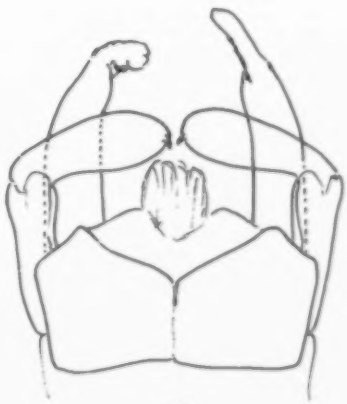
17

18

19

20

21

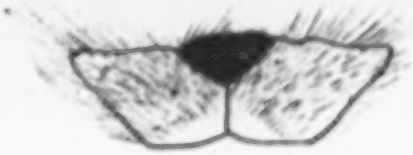


22

FIGURES 17–22.—*Chloronia antilliensis:* 17, male genitalia, dorsal; 18, male genitalia, ventral; 19, tenth gonostyli and gonocoxites, ventral. *Chloronia banksiana:* 20, tenth gonostyli and gonocoxites, ventral; 21, male genitalia, dorsal; 22, male genitalia, ventral.

BEST DOCUMENT AVAILABLE

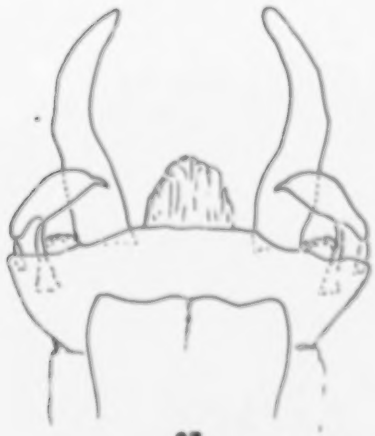
23



24

25

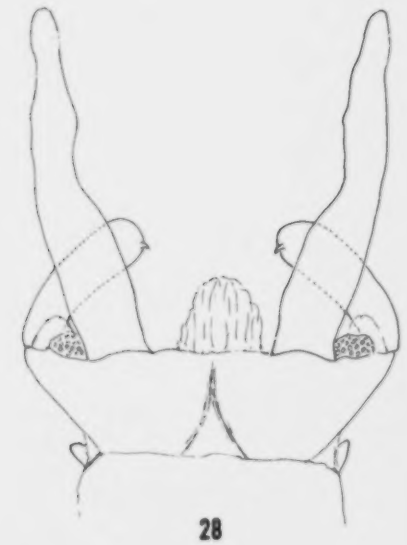
26



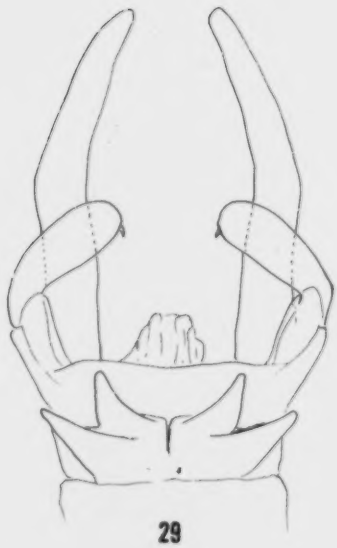
27

FIGURES 23–27.—*Chironia hegetana*: 23, male genitalia, ventral; 24, ninth sternites, ventral. *Chironia hieroglyphica*: 25, tenth gonostyli and gonocoxites, ventral; 26, male genitalia, dorsal; 27, male genitalia, ventral.

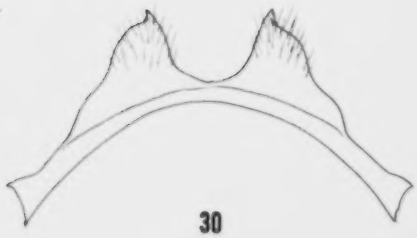
BEST DOCUMENT AVAILABLE



28

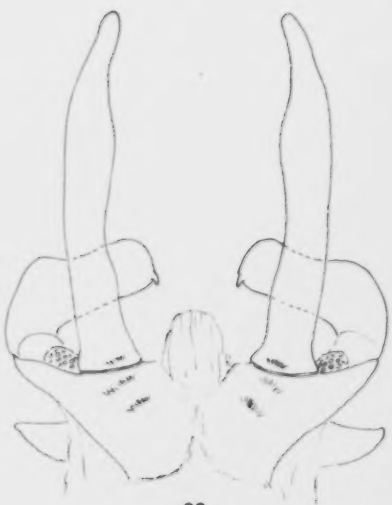


29

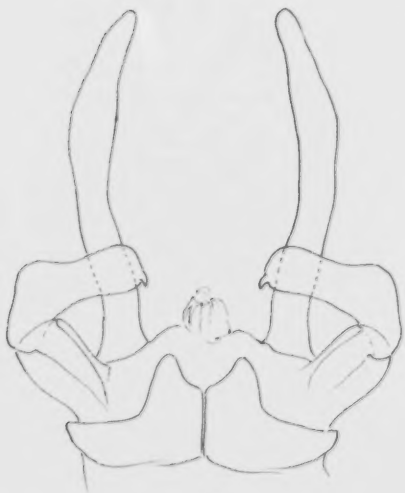


30

31



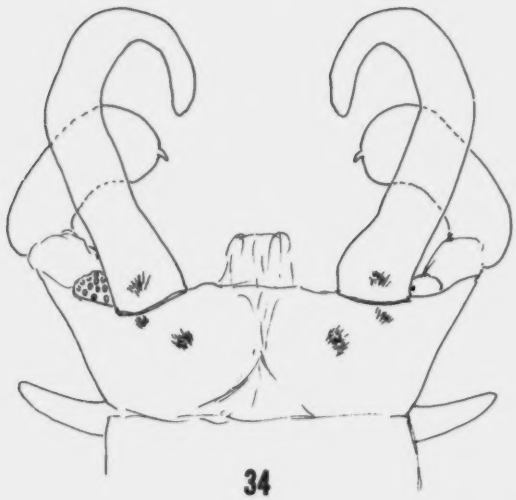
32



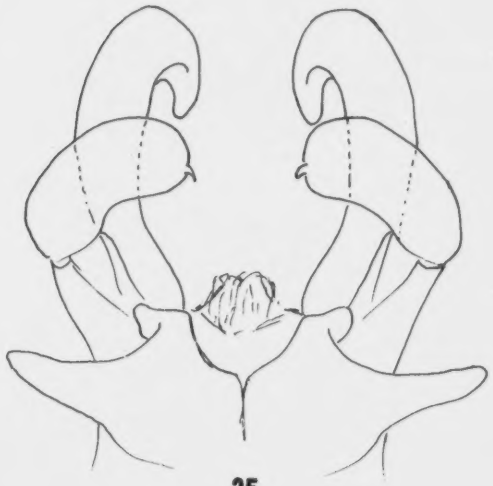
33

FIGURES 28–33.—*Chloronia mirifica:* 28, male genitalia, dorsal; 29, male genitalia, ventral; 30, tenth gonostyli and gonocoxites, ventral. *Chloronia gloriosoi:* 31, tenth gonostyli and gonocoxites, ventral; 32, male genitalia, dorsal; 33, male genitalia, ventral.

BEST DOCUMENT AVAILABLE



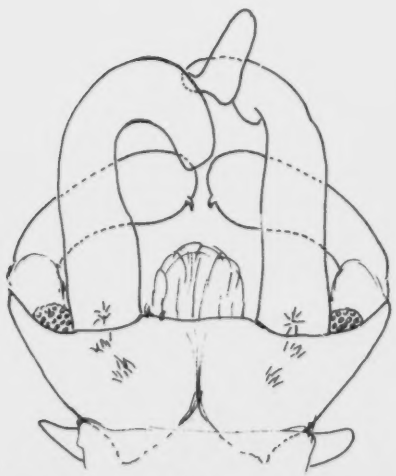
34



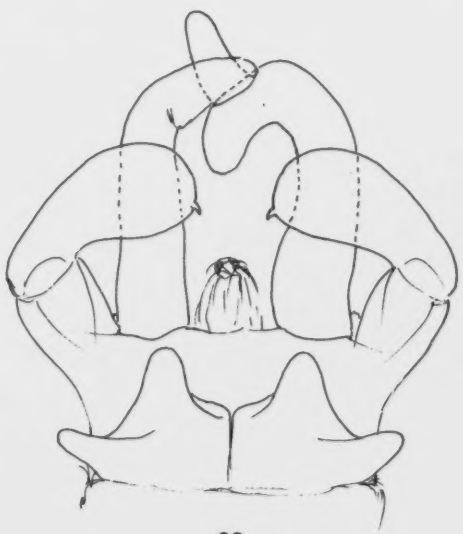
35

36

37



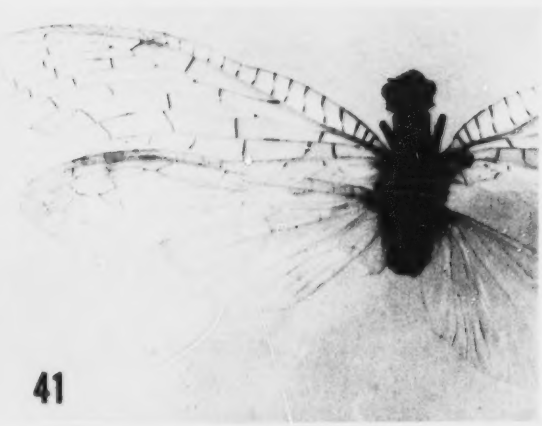
38



39

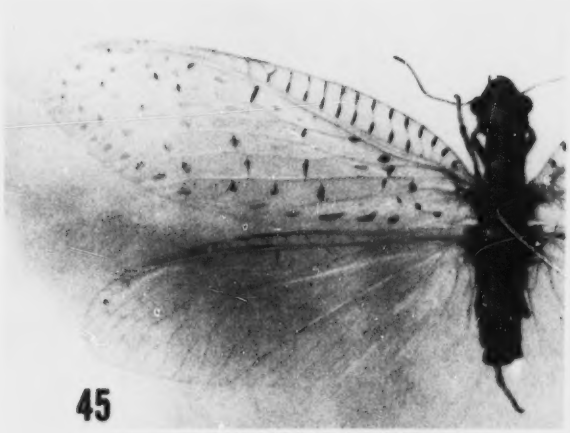
FIGURES 34–39.—*Chloronia mexicana:* 34, male genitalia, dorsal; 35, male genitalia, ventral; 36, tenth gonostyli and gonocoxites, ventral. *Chloronia pallida:* 37, tenth gonostyli and gonocoxites, ventral; 38, male genitalia, dorsal; 39, male genitalia, ventral.

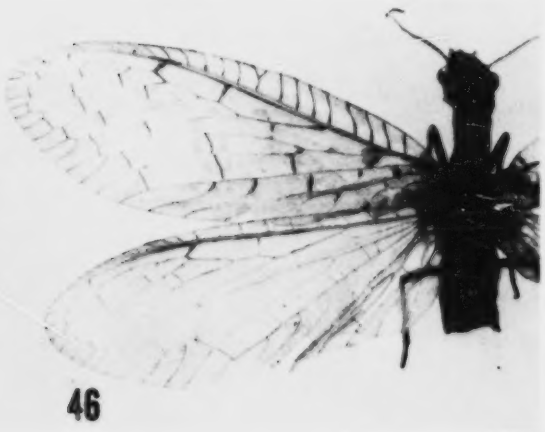
BEST DOCUMENT AVAILABLE

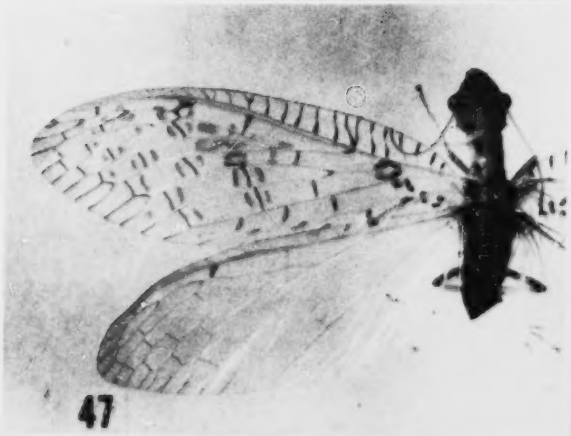


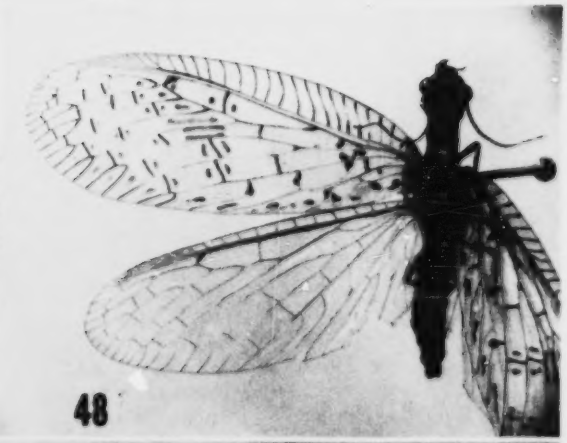
FIGURES 40–44.—Wings: 40, *C. corripiens*, type; 41, *C. wnthemi*, type; 42, *C. meridionalis*, type; 43, *C. plaumanni*. Head and thorax: 44, *C. plaumanni*.

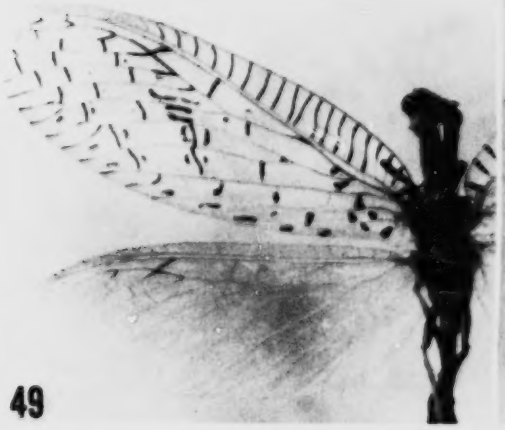
BEST DOCUMENT AVAILABLE

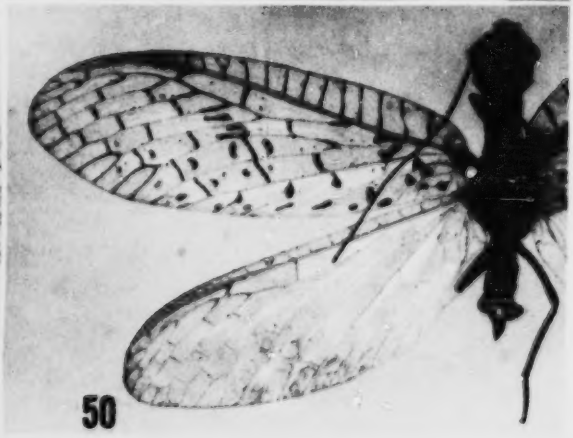


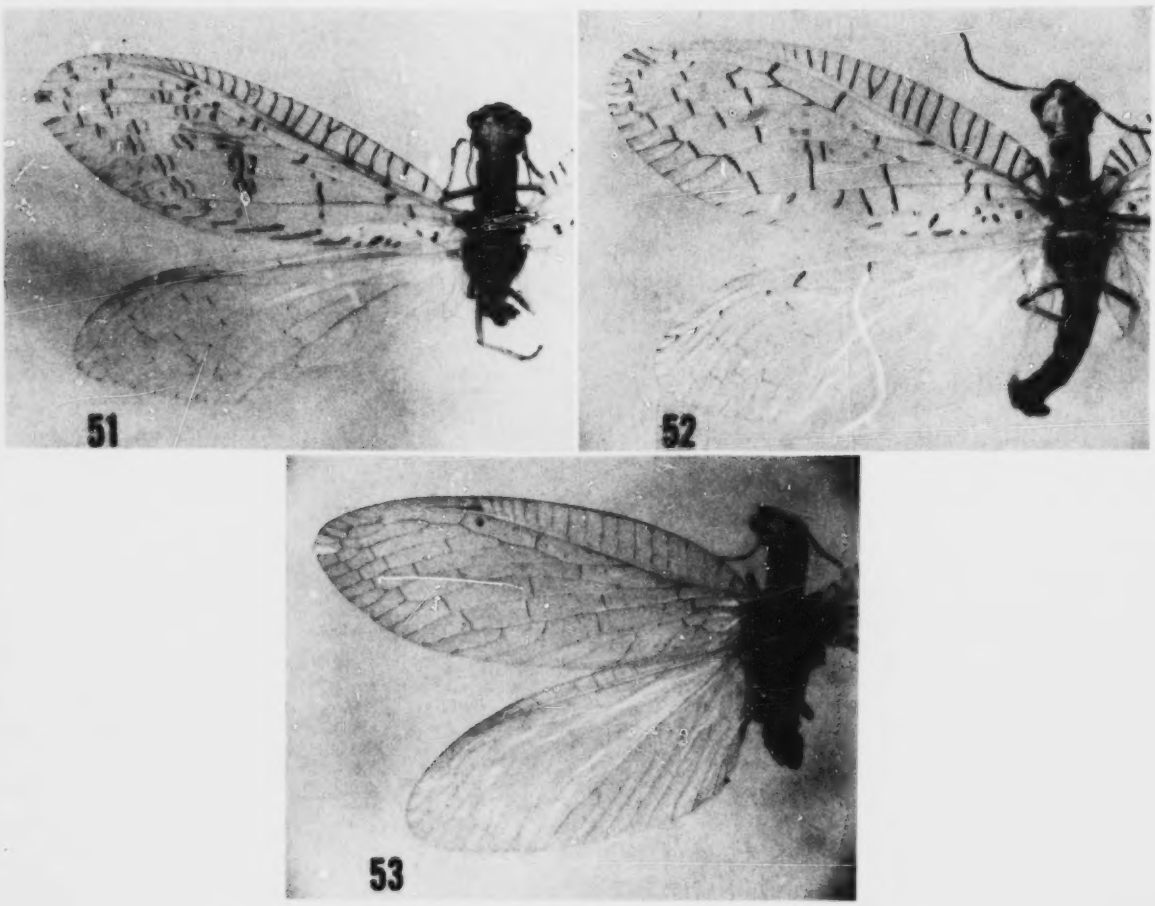




FIGURES 45–50.—Wings: 45, *C. antilliensis*, allotype; 46, *C. bogotana*, type; 47, *C. banksiana*, topotype; 48, *C. hieroglyphica*; 49, *C. mirifica*, neotype; 50, *C. hieratica*, type.

BEST DOCUMENT AVAILABLE




FIGURES 51–53.—Wings: 51, *C. gloriosoi*, type; 52, *C. mexicana*; 53, *C. pallida*, type.

BEST DOCUMENT AVAILABLE

## REQUIREMENTS FOR SMITHSONIAN SERIES PUBLICATION

**Manuscripts** intended for series publication receive substantive review within their originating Smithsonian museums or offices and are submitted to the Smithsonian Institution Press with approval of the appropriate museum authority on Form SI–36. Requests for special treatment—use of color, foldouts, casebound covers, etc.—require, on the same form, the added approval of designated committees or museum directors.

**Review** of manuscripts and art by the Press for requirements of series format and style, completeness and clarity of copy, and arrangement of all material, as outlined below, will govern, within the judgment of the Press, acceptance or rejection of the manuscripts and art.

**Copy** must be typewritten, double-spaced, on one side of standard white bond paper, with $1\frac{1}{4}$" margins, submitted as ribbon copy (not carbon or xerox), in loose sheets (not stapled or bound), and accompanied by original art. Minimum acceptable length is 30 pages.

**Front matter** (preceding the text) should include: **title page** with only title and author and no other information, **abstract page** with author/title/series/etc., following the established format, **table of contents** with indents reflecting the heads and structure of the paper.

**First page of text** should carry the title and author at the top of the page and an unnumbered footnote at the bottom consisting of author's name and professional mailing address.

**Center heads** of whatever level should be typed with initial caps of major words, with extra space above and below the head, but with no other preparation (such as all caps or underline). Run-in paragraph heads should use period/dashes or colons as necessary.

**Tabulations** within text (lists of data, often in parallel columns) can be typed on the text page where they occur, but they should not contain rules or formal, numbered table heads.

**Formal tables** (numbered, with table heads, boxheads, stubs, rules) should be submitted as camera copy, but the author must contact the series section of the Press for editorial attention and preparation assistance before final typing of this matter.

**Taxonomic keys** in natural history papers should use the aligned couplet form in the zoology and paleobiology series and the multi-level indent form in the botany series. If cross-referencing is required between key and text, do not include page references within the key, but number the keyed-out taxa with their corresponding heads in the text.

**Synonymy** in the zoology and paleobiology series must use the short form (taxon, author, year:page), with a full reference at the end of the paper under "Literature Cited." For the botany series, the long form (taxon, author, abbreviated journal or book title, volume, page, year, with no reference in the "Literature Cited") is optional.

**Footnotes**, when few in number, whether annotative or bibliographic, should be typed at the bottom of the text page on which the reference occurs. Extensive notes must appear at the end of the text in a notes section. If bibliographic footnotes are required, use the short form (author/brief title/page) with the full reference in the bibliography.

**Text reference system** (author/year/page within the text, with the full reference in a "Literature Cited" at the end of the text) must be used in place of bibliographic footnotes in all scientific series and is strongly recommended in the history and technology series: "(Jones, 1910:122)" or ". . . Jones (1910:122)."

**Bibliography**, depending upon use, is termed "References," "Selected References," or "Literature Cited." Spell out book, journal, and article titles, using initial caps in all major words. For capitalization of titles in foreign languages, follow the national practice of each language. Underline (for italics) book and journal titles. Use the colon-parentheses system for volume/number/page citations: "10(2):5–9." For alinement and arrangement of elements, follow the format of the series for which the manuscript is intended.

**Legends** for illustrations must not be attached to the art nor included within the text but must be submitted at the end of the manuscript—with as many legends typed, double-spaced, to a page as convenient.

**Illustrations** must not be included within the manuscript but must be submitted separately as original art (not copies). All illustrations (photographs, line drawings, maps, etc.) can be intermixed throughout the printed text. They should be termed **Figures** and should be numbered consecutively. If several "figures" are treated as components of a single larger figure, they should be designated by lowercase italic letters (underlined in copy) on the illustration, in the legend, and in text references: "Figure 9b." If illustrations are intended to be printed separately on coated stock following the text, they should be termed **Plates** and any components should be lettered as in figures: "Plate 9b." Keys to any symbols within an illustration should appear on the art and not in the legend.

**A few points of style:** (1) Do not use periods after such abbreviations as "mm, ft, yds, USNM, NNE, AM, BC." (2) Use hyphens in spelled-out fractions: "two-thirds." (3) Spell out numbers "one" through "nine" in expository text, but use numerals in all other cases if possible. (4) Use the metric system of measurement, where possible, instead of the English system. (5) Use the decimal system, where possible, in place of fractions. (6) Use day/month/year sequence for dates: "9 April 1976." (7) For months in tabular listings or data sections, use three-letter abbreviations with no periods: "Jan, Mar, Jun," etc.

**Arrange and paginate sequentially EVERY sheet of manuscript**—including ALL front matter and ALL legends, etc., at the back of the text—in the following order: (1) title page, (2) abstract, (3) table of contents, (4) foreword and/or preface, (5) text, (6) appendixes, (7) notes, (8) glossary, (9) bibliography, (10) index, (11) legends.

BEST DOCUMENT AVAILABLE